GCSE
DESIGN AND TECHNOLOGY
8552/W

Unit 1 Written Paper

Mark scheme

June 2023

Version: 1.0 Final

2 3 6 G 8 5 5 2 / W / M S

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

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Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Glossary for maths

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

[a, b]	Accept values between a and b inclusive.
For π	Accept values in the range [3.14, 3.142]
Their	Accept an answer from the candidate if it has been inaccurately calculated but is subsequently used in a further stage of the question.

Questions which do not ask students to show working

As a general principle, a correct response is awarded full marks.

Qu	Part	Marking Guidance	Total marks	AO
01		**A** Carbon fibre reinforced plastic (CRP)	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
02		**D** Oil is extracted from the ground to produce petroleum.	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
03		**D** Zinc carbon batteries leak and corrode.	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
04		**B** High density polythene (HDPE)	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
05		**D** Malleability	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
06		**C** lean manufacture.	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
07		**C** Reciprocating	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
08		**C** Focus on people	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
09		**D** Wind	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
10		**D** Thermochromic pigment	1 mark	AO4 1a

Qu	Part	Marking Guidance	Total marks	AO
11	1	One mark for a correct named manufactured board.	1 mark	AO4 1a

Indicative content

- Medium density fibreboard (MDF)
- High density fibreboard
- Plywood
- Aero ply
- Chipboard
- Laminboard
- Blockboard
- Strawboard
- Glulam
- Hardboard
- Pinboard
- Stirling board

ACCEPT GRAPHICS BASED BOARDS e.g., cardboard, corrugated board, duplex, foamboard, solid white board, inject.

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>11</td><td>2</td><td><table>
<tr><td>2 marks</td><td>One point explained in detail, possibly using specific examples.</td></tr>
<tr><td>1 mark</td><td>One correct simple point of explanation.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table></td><td>2 marks</td><td>AO4 1b</td></tr>
<tr><td colspan="5">Indicative content

• To ensure that the whole of the tree is used and there is no waste e.g., knots, surface defects etc that have to be avoided.
• Produce large flat boards.
• Produce boards of a consistent thickness which are better for making accurate engineered products e.g., flat-pack furniture.
• Produce flat boards that are less likely to warp.
• Some manufactured boards have a smooth surface finish which can be painted to produce a high-quality finish or have a laminate bonded to it to create a durable hard-wearing surface e.g., kitchen worktops.
• Better for the environment as the whole tree can be used e.g., chipboard.
• Use of recycled
• Create a timber with enhanced properties that is stronger and more suited to modern engineered buildings and structures e.g., glulam where long, consistent beams can be manufactured.

Accept all other valid responses including graphic responses.</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>12</td><td></td><td>
<table>
<tr><td>3 marks</td><td>Two simple/one detailed point of explanation clarifying understanding AND an example.</td></tr>
<tr><td>2 marks</td><td>One detailed point of explanation with no example
OR
Two simple points of explanation with no example
OR
One simple point and example.</td></tr>
<tr><td>1 mark</td><td>One simple point of explanation OR a correct example.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
</td><td>3 marks</td><td>AO4 1b</td></tr>
<tr><td colspan="5">Indicative content

The guidance provided is illustrative and not exhaustive. Credit any worthy points made in support of the band descriptors above.

• Because a product may only be designed to have a short useful life e.g., disposable products like a milk carton, contact lenses, disposable razors.
• A company may take the view of designing a limited lifespan into a product to ensure continuous demand e.g., mobile phone before a new, improved replacement comes along.
• Product may be designed and made so that after a time cannot be repaired or upgraded. A company may not want to invest time and resources (spare parts and technical support) supporting old tech e.g., a flat-screen TV.
• Some manufacturers design products with planned obsolescence in mind to ensure there is always a market for new and improved products/sales to keep the company profitable, e.g., computer game companies. Upgrades/speeds/better graphics are all part of a more realistic experience for gamers. Computers become obsolete unless upgraded.
• Planned obsolescence can lead to waste.
• Some products are made of inferior quality/ fragile, so they break and need to be replaced.

CONSUMABLE PRODUCTS ARE INCORRECT.

Accept all other valid responses</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>13</td><td></td><td>One mark for each correct advantage given.

<table><tr><td>1 mark</td><td>Any correct advantage given.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table></td><td>2 marks</td><td>AO4 1b</td></tr>
<tr><td colspan="5">Indicative content

• Highly visible way of reaching interested parties/investors.
• Raise awareness of cause.
• Linked to social media to maximise exposure.
• Uses the internet for exposure so is a global way of raising funds.
• No need for ‘cold calling’.
• Does not require big investors, but does require many.
• Little financial risk associated with big start-up costs.
• Good way for entrepreneurs to raise funds without having to go and find backers directly.
• A fast way to raise money with no up-front fees.

Accept all other valid responses.</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>14</td><td></td><td><table><tr><td>2 marks</td><td>Any two correct points relating to motion direction and magnitude of gear C</td></tr><tr><td>1 mark</td><td>One correct point about motion or magnitude. Can include indicated use of arrow.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table></td><td>2 marks</td><td>AO4 1c</td></tr>
<tr><td colspan="5">Indicative content

WE ARE ONLY MARKING DESCRIPTIVE POINTS FOR GEAR C

<table><tr><th>Direction:</th><th>Magnitude:</th></tr><tr><td>Gear C turns clockwise</td><td>• Gear C turns the slowest of all (as it has the most teeth)
• C goes slower that A
• Takes longer time to rotate.
• 19:26 ratio</td></tr></table>
Accept all other valid responses.</td></tr>
</table>

Qu	Part	Marking Guidance	Total marks	AO
15		Costing of buttons to make 1500 coats: AWARD FULL MARKS FOR CORRECT ANSWER, EVEN WITH NO WORKING SHOWN	3 marks	AO4 1c

1 mark	**Step 1:** 4 × 14 = 56 + (1 × 14) = 70 OR 5 × 14 = 70 total	4 × 0.14 = 0.56 + 0.14 = 0.70 OR 5 × 0.14 = 0.70	1500 × 5 = 7500
1 mark	**Step 2:** 1500 × 70 (their 70) = 105 000 (their 105 000) pence	1500 × (their 0.70) = 1050 (their 1050)	7500 × 0.14 = 1050
1 mark	**Step 3:** £1050	£1050	£1050

Qu	Part	Marking Guidance	Total marks	AO
16		**Two** marks maximum for **each** consideration.	4 marks	AO4 1c

2 marks	One consideration explained in detail, possibly using an example to clarify response.
1 mark	One simple correct point given for each consideration.
0 marks	No response or nothing worthy of credit.

Indicative content

- Surface finish – does the surface need to be shiny or matt?
- Texture – does the surface a visual appearance?
- Colour – does the material or component need to be coloured in some way?
- Pattern – some materials have a pattern e.g., wood grain, fabric design to enhance appearance.
- Matching – does the material being used match or sit well with other materials used in the prototype?

Responses may also look at:

- will the base material absorb or take a good finish? A material that won't stain or is too flexible to be painted may be rejected.
- will the aesthetics (looking good) be maintained for a long time? E.g., how long before an object needs re-plating or painting or waxing? etc.

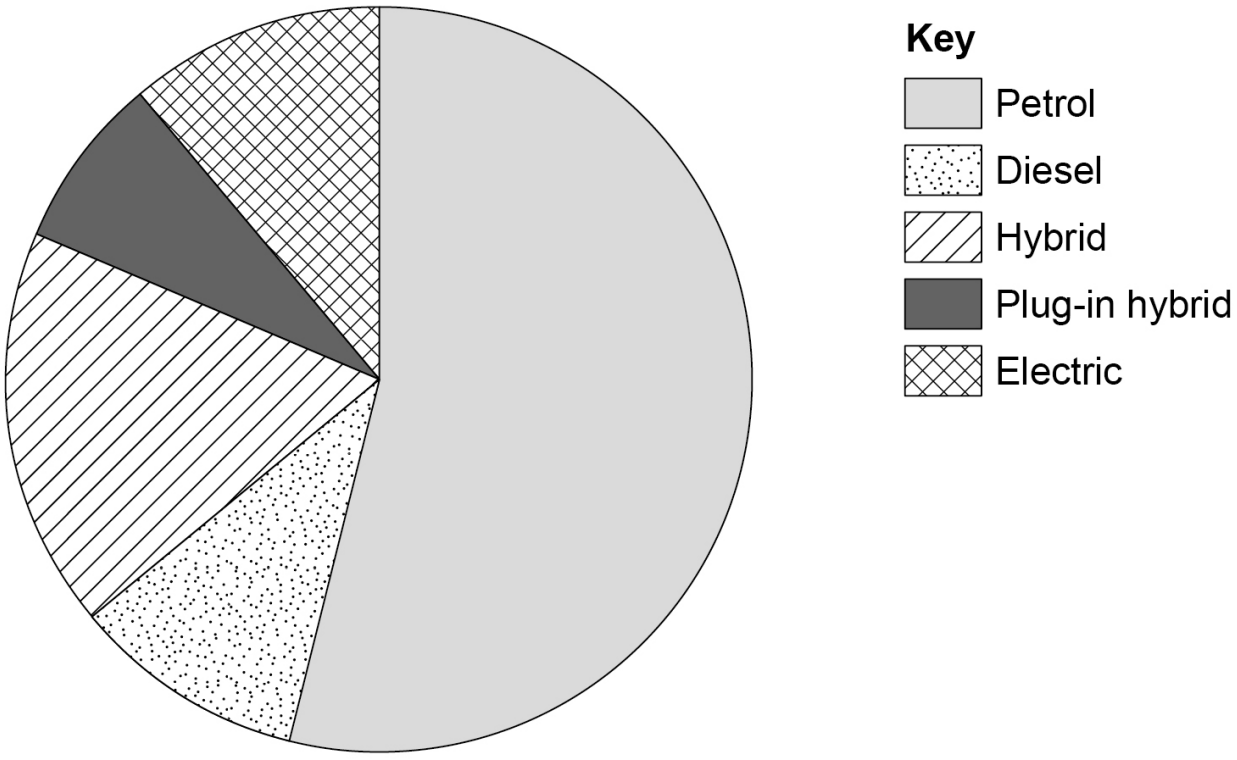
Accept all other valid responses.

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>17</td><td></td><td>This question requires candidates to recognise that 3.6 degrees equals 1%, calculate the correct sector angles for diesel and hybrid cars and then indicate on the pie chart.

IF PIE CHART IS CORRECTLY SHADED AND LINE DRAWN WITHIN A 2 DEGREES TOLERANCE IT IS FULL MARKS.

<table>
<tr><td>1 mark</td><td>Correct calculation of 1% to be 3.6 degrees.</td></tr>
<tr><td>1 mark</td><td>Correct calculation/ representation of either 36-degree segment for diesel cars OR 63-degree segment for hybrid cars.</td></tr>
<tr><td>1 mark</td><td>Correct position of a single line. Line must be within 2-degree tolerance i.e. 36 +/- 2 degrees or 63+/- 2 %.</td></tr>
<tr><td>1 mark</td><td>Correct application of key.</td></tr>
</table>
</td><td>4 marks</td><td>AO4 1c</td></tr>
<tr><td colspan="5">Indicative content

THE TWO SEGMENTS CAN BE DRAWN THE OPPOSITE WAY ROUND.

 
</td></tr>
</table>

Qu	Part	Marking Guidance	Total marks	AO
18	1	**Indicative content**	1 mark	AO4 1c

Specific main material:

Process	**Specific main material for 1 mark.**
Paper and board die cutting	Any specific named paper e.g., cartridge paper, layout paper Any specific paper-based board e.g., cardboard, corrugated cardboard, solid white board
Wood turning	Any specific named wood e.g., beech, ash
Metal casting	Any specific named metal e.g., aluminium, pewter
Polymer extrusion	Any specific named polymer e.g., acrylic, nylon
Textile weaving	Any specific named textile fibre e.g., cotton, polyester
Electronic pick and place assembly	Any specific named material e.g., PCB board, solder

NB If a candidate has **NOT** selected or indicated which process they have chosen, **BUT** the material given is appropriate for one of the question processes, then mark can be awarded.

Qu	Part	Marking Guidance	Total marks	AO
18	2	**Indicative content**	1 mark	AO4 1c

Stock form:

Process	Only accept these stock forms
Paper and board die cutting	Sheet, roll
Wood turning	Plank, board, log, (bowl) blank
Metal casting	Ingot, bar
Polymer extrusion	Powder, granules, pellets
Textile weaving	Yarn, thread, hank
Electronic pick and place assembly	Board, PCB board, reel of solder

NB Stock form **must** be correct for the process not the material **BUT** if a process has not been selected a mark can be awarded if the stock form matches the main material given in 18.1.

Qu	Part	Marking Guidance	Total marks	AO
18	3	The question requires the candidate to detail **two** reasons to access all four available marks. 2 marks – One correct reason clarified in detail. 1 mark – One correct reason identified in brief. 0 marks – No response or nothing worthy of credit. **NB** If a process has **not** been selected or it is unclear which process is the focus of the response award no marks.	4 marks	AO4 1c

Indicative content

Die cutting.
- Multiple copies of nets can be cut in one go e.g., leaflets.
- Cutting and/or creasing and/or perforations can be added at the same time e.g., tissue boxes.
- Speeds up the production of cardboard packaging for mass manufacture of product packaging e.g., mobile phone packaging.
- Once set up process allows for highly accurate, repetitive production of die-cut items.
- A net can be cut out as a flat shape and assembled into a 3D construction at a later point e.g., pizza box.

Turning
- Suited to CAD/CAM production for high volume wood products e.g., staircase spindles.
- Work piece is spun/rotates meaning material is removed rapidly.
- Turn consistent circular shapes e.g., bowls, cylinders without having to care for them by hand.
- Quick finishing of the turned surface as you do not have to move abrasive paper by hand. You just touch the surface of the work piece, and it rubs against the abrasive paper with no effort from the worker e.g., using glass paper.
- Several processes can be performed with the work piece set up once e.g., scraping, sanding, and applying a finish.

Casting
- A molten metal can be poured into a mould, so the metal takes on a complex shape and requires less processing e.g., casting for a mechanical pump.
- Leftover metal can be re-melted and reused again, reducing waste. Reduces material cost and can increase profit margins.
- Die casting is used to create highly accurate (fine detail) metal components where the material is gravity fed or pressure fed into a mould e.g., die casting metal figures/warcraft.
- A quality finish can be achieved, reducing finishing costs of mass manufactured products e.g., no need to paint etc.

Extrusion
- If long lengths/large quantities of a constant profile are required, a material can be 'pushed' through a die of a given shape/profile e.g. polymer tubes.
- Dimensional accuracy along a material length can be maintained by the profile.
- Complex cross-sectional profiles can be created in one process without the need for additional wastage processes.
- Extruded material can be cut and/or rolled in some cases for transportation and storage.

Weaving
- Weaving looms can be automated and linked to CAD to allow for changes in pattern design of a very large scale.
- Designs can undergo a 'test weave' to assess the suitability of a design for commercial manufacture before committing too much time and resources on production.
- Once set up, weaving looms can produce very large quantities of fabric at low cost due to reduced human involvement.
- Woven fabric can be constructed in different ways to give a wide variety of different qualities such as strength, durability, aesthetic appeal, drape and comfort.

Pick and place assembly.
- Allows the manufacturers of electronic products to employ surface-mount technology to populate PCBs.
- Highly suited to automated circuit construction meaning components can be placed very accurately.
- Accurate placement using CAD/Robots means that components can be placed closer together than by hand.
- Pick and place machines monitor reserves of components as they are held in cartridges or reels and stop production when they are depleted, meaning materials and time are not wasted making incomplete PCBs.

Accept all other valid responses.

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>19</td><td>1</td><td>
<table>
<tr><td>1 mark</td><td>Correct name.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
NB The Mark Scheme for Question 19 is looking for linking between specific tool name AND appropriate AND THEN correct use and the safety.
</td><td>1 mark</td><td>AO4 1c</td></tr>
<tr><td colspan="5">Indicative content
<table>
<tr><th>Name of tool</th></tr>
<tr><td>A = Chisel</td></tr>
<tr><td>B = Soldering iron</td></tr>
<tr><td>C = Hacksaw/junior hacksaw</td></tr>
<tr><td>D = Pinking shears/ Pinking scissors. DO NOT ACCEPT SCISSORS ALONE</td></tr>
<tr><td>E = Rotary cutter/paper guillotine/guillotine/ paper trimmer</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>19</td><td>2</td><td>
<table>
<tr><td>2 marks</td><td>Two simple points of use or one clarified in detail.</td></tr>
<tr><td>1 mark</td><td>One simple correct descriptive point.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
</td><td>2 marks</td><td>AO4 1c</td></tr>
<tr><td colspan="5">
Indicative content

NB Credit if explanation is appropriate for named tool. Do not double penalise.

<table>
<tr><th>Name of tool</th><th>Use of tool</th></tr>
<tr><td>A = Chisel</td><td>• Used to remove wood shavings from natural timbers when cutting woodwork joints e.g., frame and box, finger joints, mortice and tenon joints.
• Paring by hand or chopping with a mallet.</td></tr>
<tr><td>B = Soldering iron</td><td>• Connecting electronic components and wire to a PCB/circuit board.
• Heating and/or melting solder to join and connect components to a PCB board.
• Heating heat shrink to encapsulate a wire to a component terminal (using side of soldering iron not tip).</td></tr>
<tr><td>C = Hacksaw/ junior hacksaw</td><td>• Used with a metalwork vice to cut bar/rod/strip and angle.
• Used to cut both metals and polymers (not wood).
• Remove a part or component from a material length of stock form material.
• Convert metal or polymers down into smaller more manageable pieces.</td></tr>
<tr><td>D = Pinking shears/scissors</td><td>• Cut fabric with a zigzag edge to neaten and stop fraying.
• To give a decorative edge.
• Neaten edge.
• Stop fraying of edge.
• Used on shop-bought fabric to make the fabric look better on purchase before use.</td></tr>
<tr><td>E = Rotary cutter/ paper guillotine/paper trimmer</td><td>• Used to cut paper and thin card down into smaller and more manageable sized pieces.
• Sizing laminated pieces of paper and card.
• Cuts a straight line with accuracy.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>19</td><td>3</td><td>
<table>
<tr><td>2 marks</td><td>Two simple correct safety points (hazard or precaution) or one point described in detail.</td></tr>
<tr><td>1 mark</td><td>One brief correct safety point (hazard or precaution) stated.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
NB Credit if safety points are appropriate for the tool named.
</td><td>2 marks</td><td>AO4 1c</td></tr>
</table>

Name of tool	Safety considerations
A = Chisel	• Keep your fingers behind the cutting edge at all times. • Do not run with a chisel in your hand in case you fall. • When carrying a chisel always carry point down. • Safety glasses/safety goggles/wearing goggles. • The chisel is sharp.
B = Soldering iron	• The iron gets hot. • Put the soldering iron in its stand when not in use. • Check the soldering iron for PAT testing sticker before use. • Never touch the hot metal tip – hold by the coloured polymer body (yellow/blue/red). • Solder in in a ventilated space • Safety glasses/safety goggles/wearing goggles.
C = Hacksaw/ junior hacksaw	• Never cut near your fingers. • Use the saw with both hands to keep the blade straight and stop it from twisting. • Slow down when cutting through material as it is about to finish cut. • Make sure the saw blade is replaced when blunt to ensure safe and effective cutting without the blade breaking. • Safety glasses/safety goggles/wearing goggles.
D = Pinking shears	• Keep your fingers away from the shearing action of the blades. • When carrying always carry point down so you don't injure yourself if you fall. • Carry the scissors in your hand by grasping the blade. • Sharp points on the blade.
E = Rotary cutter/paper guillotine	• Ensure that all guide strips are in place so fingers cannot be placed in front of the rotating wheel/blade. • Store away securely so that the cutter cannot fall on you and harm you. • Do not overload the paper cutter with too much material so that the paper cutting wheel does not jam/stop suddenly.

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>20</td><td></td><td>
<table>
<tr><td>7–8 marks</td><td>A detailed consideration of advantages and disadvantages manufacturing in quantity can have over producing a one-off item. Different scales of production evident, and where and why they would be used. Relevant example(s) of products/manufacturing processes/situations of use to clarify response for this band award.</td></tr>
<tr><td>5–6 marks</td><td>A good consideration of advantages and disadvantages manufacturing in quantity can have over producing a one-off item. Good evidence of different scales of production considered. Some examples of products/manufacturing processes/situations of use to clarify response for this band award.</td></tr>
<tr><td>3–4 marks</td><td>A basic consideration of some advantages and disadvantages manufacturing in quantity can have over producing a one-off item. Limited evidence of different scales of production considered. No attempt to evaluate or offer a personal judgement. Very limited or no examples to support response given.</td></tr>
<tr><td>1–2 marks</td><td>One or two limited advantage or disadvantage points given. No examples given.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
</td><td>8 marks</td><td>AO3 2a
AO3 2b</td></tr>
<tr><td colspan="5">

Indicative content

Expect candidates to talk about different scales of production, particularly batch, mass, and continuous production for manufacturing in quantity.

Prototype/one off

- Used to make an early version of a product/system to test a concept and see how well a component/part/feature works e.g., toile for a dress, concept vehicle.
- Used for a unique/personalised piece of work/product e.g., jewellery, handmade suit, where only one example will be required.
- 3D printing can be used to rapidly create a one-off prototype product of concept e.g., artificial implants used in surgery.
- This production technique is used where the manufacturer usually can work directly with the customer/end user /client and meet their very specific and personalised requirements e.g., wedding dress.
- Very labour intensive using highly skilled persons.

Batch

- Used where a specific number of a product are required.
- Using jigs and templates in batch production allows more of a component to be made later.
- Small changes between batches e.g., colour of phone cases is possible.
- Products/systems are produced in a higher volume than one-off /prototype production but less than mass and continuous production.

</td></tr>
</table>

- Products created are identical and usually referred to as a batch e.g., rolls of wallpaper, components, perishable foods.
- Batches can be very small or quite large depending on complexity.
- Technique makes use of highly skilled persons to make products, but repetitive nature of batch production may require production lines and the use of jigs, former, templates and stencils to ensure consistency.

Mass

- Items tend to be consistently used where there is little change in the design eg white goods and electrical goods.
- Mass production involves high initial start-up costs in equipment and machinery that is recouped due to larger production runs e.g., car manufacture where product costs can be reduced and passed on to customers.
- Increasing levels of automation and use of robots to speed up production, minimise waste and increase efficiency.
- Mass production makes use of highly skilled technicians to keep the production line running smoothly.
- Minimal downtime in production to keep production rates high.

Continuous

- Where simple products or components are continually in demand and never change e.g., screws, zips, switches, resistors.
- Like mass production, but production lines run 24/7.
- Trying to keep production costs as low as possible so products can be produced for as little as possible.
- Staff usually low skilled.
- Very high levels of automation e.g., pick and place machines for PCB assembly.
- Factories using commercial production techniques make a very limited number of products (limited range) with few or no changes to the product.

Accept all other valid responses.

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>21</td><td></td><td>
<table>
<tr><td>5–6 marks</td><td>A thorough understanding of how prototyping helps test that a prototype or part of it is fit for purpose and will work. Response makes use of clear examples to clarify point(s) made in more detail.</td></tr>
<tr><td>3–4 marks</td><td>Good understanding of how prototyping helps test that a prototype or part of it is fit for purpose and will work. Response may use generic examples to clarify a point made in more detail.</td></tr>
<tr><td>1–2 marks</td><td>A basic understanding with one brief point made which links to prototypes and their use to test.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
</td><td>6 marks</td><td>AO4 2b</td></tr>
<tr><td colspan="5">Indicative content

Response should focus on testing of the product to ensure it meets the original product brief, client needs and wants, functionality and marketability. Is it fit for purpose and does what it should? We are not looking for generic reference to development, i.e., modelling.

• Build and test a prototype to see if it does what the design brief wants.
• A prototype allows a design or iteration to become ‘real’ and allows both designers and potential clients to test parts and review and see how it matches the requirements of the brief.
• Will the prototype do what the customer wants?
• Allows for rapid realisation and visualisation for testing e.g., electrical system, a part or combined components.
• Allows for parts or elements to be prototype for testing against the design brief.
• They can help refine and inform changes that need to be made to create an effective product and make safe for sale.
• Test safety for the customer and meet safety requirements e.g., BSI, CE, PAT tested.
• Will the product be marketable (sell) in terms of aesthetics/looks?
• Does the product work/function as intended for sale?
• How does it compare to similar products sold on the market?
• Prototypes allow for material and manufacturing experimentation to check marketability in terms of cost, usability before scaling up to mass production etc.
• Allow for a prototype to be physically evaluated by focus groups and potential customers.

Accept all other valid responses.</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>22</td><td>1</td><td>
<table>
<tr><td>5–6 marks</td><td>Thorough analysis and evaluation of both bags considering their suitability for children to use.</td></tr>
<tr><td>3–4 marks</td><td>Good analysis and simple evaluative points of one or more bags considering their suitability for children to use.</td></tr>
<tr><td>1–2 marks</td><td>Basic analysis of one or two simple suitability points for either rucksack or drawstring bag.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
</td><td>6 marks</td><td>AO3 1a
AO3 1b</td></tr>
<tr><td colspan="5">

Indicative content

Expect responses to consider needs (essential things) and wants (desirable things) of a child or teenager.

The guidance provided is illustrative and not exhaustive. Credit any worthy points made in support of the band descriptors above.

Rucksack

- Somewhere to carry a drinks bottle for break time. Prevents the bottle from getting lost.
- Lots of pockets for things like phone, pencil case, calculator.
- Zips and clips for security so items do not fall out and get lost.
- Adjustable straps for comfort. The padding will also make it easier to carry the bag a long time.
- Made from a hard-wearing material so holes do not appear from placing/dragging on rough surfaces e.g., playground.
- It keeps the contents dry.
- Protects fragile things from being crushed or damaged.
- Different things can have their own place to help keep them safe and organised.
- Colourful graphics to appeal to the user.
- Plastic feet at base to protect the bag.
- Options for how to carry the bag – handle and straps.
- Reflector triangles for safety.
- Add a negative point for evaluation such as the rucksack may be expensive.

Drawstring bag

- Easy to customise and personalise to own taste e.g., writing name on, adding badges, stickers, and keychains.
- Can get your fingers caught in clips like with the rucksack.
- Can fold away when not full/in use.
- The bag expands to fit more things in. You are not limited by compartment size.
- The string might fall out so the bag can't be closed.
- Thin material so a hole might wear in it easily.
- Difficult to find what you want if the bag is full of things.
- It keeps the contents dry.
- Strings may be uncomfortable when carrying the bag.

Accept all other valid responses.

</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>22</td><td>2</td><td>
<table>
<tr><td>5–6 marks</td><td>Thorough analysis and evaluation of both bags considering ergonomics and anthropometrics.</td></tr>
<tr><td>3–4 marks</td><td>Good analysis and simple evaluative points of one or more bags considering ergonomics and/or anthropometrics.</td></tr>
<tr><td>1–2 marks</td><td>Basic analysis points of one or two ergonomic or anthropometric points for either the rucksack or drawstring bag.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
</td><td>6 marks</td><td>AO3 1a
AO3 1b</td></tr>
<tr><td colspan="5">

Indicative content

Analysis – identification of different bag features.
Evaluation – judgement and personal consideration as to the value of each bag feature.

The guidance provided is illustrative and not exhaustive. Credit any worthy points made in support of the band descriptors above.

Ergonomics
- How the user interacts with the bag(s) e.g., organising.
- The rucksack has comfortable straps for carrying on the shoulders.
- Adjustable straps for comfort.
- Ergonomically designed and shaped one-piece handle for comfort on the rucksack unlike the string on the drawstring bag.
- The drawstring bag will dig into your shoulders or hands when carrying for a long time.
- Reflective panels for safety and night to keep the user visible. This will help reassure parents a child is safe and make them easier to spot by car drivers.
- Clips can be seen that make a firm ‘click’ sound, so you know you have locked it.
- The bag has edges that are made from softer material so that they don’t cut your hands.
- Drawstring bag is made from softer material that is more comfortable to handle.

Anthropometrics
- The clips will be sized so the user’s fingers can fit round them to open and close them.
- Straps long enough to fit on the back of a child.
- Carrying handle on the rucksack is designed to be the right size for a child’s hand.
- The polymer lock mechanism on the drawstring bag can be too small to operate if your hand is wet e.g., after swimming.

Accept all other valid responses.

</td></tr>
</table>

Qu	Part	Marking Guidance	Total marks	AO
23	1	1 mark: 25 divided by 2 = 12.5 mm	1 mark	AO4 2c

Qu	Part	Marking Guidance	Total marks	AO
23	2	Two methods:	2 marks	AO4 2c

	Method 1	**Method 2**
1 mark	120 divided by 8 (their 8)	120-49= 71
1 mark	15 mm	15.875mm

Qu	Part	Marking Guidance	Total marks	AO
23	3	Two methods:	2 marks	AO4 2c

	Method 1	**Method 2**
1 mark	Distance between hole centres = 15 (their 15) - 7	Distance between hole centres = 15.875 (their 15.875) - 7
1 mark	= 8 mm	= 8.875 mm

Qu	Part	Marking Guidance	Total marks	AO
23	4	Minimum drill size = 6.5 mm & maximum drill size = 7.5 mm **No mark if both correct measurements are not given.** **Accept if correct values are given but written wrong way round.**	1 mark	AO4 2c

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>24</td><td></td><td>
<table>
<tr><td>3 marks</td><td>A very detailed explanation with clear linking to the work of others. Response may use one detailed point of explanation or several simpler creditworthy points of explanation.</td></tr>
<tr><td>2 marks</td><td>A detailed explanation or two simple creditworthy points of explanation.</td></tr>
<tr><td>1 mark</td><td>One brief creditworthy point made.</td></tr>
<tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr>
</table>
</td><td>3 marks</td><td>AO4 2b</td></tr>
<tr><td colspan="5">Indicative content

• Get some design inspiration before starting own design work.
• To ensure own designs are original and new.
• Can provide new starting points to make a better or improved design.
• Identify features that work well and those that work less well.
• Get inspiration on how shapes and colours combine in existing designs e.g., textiles and soft furnishings.
• By looking at a range of designers you may get information and ideas of how to design a product in many ways.
• Provides an opportunity to look at materials and technologies used by other designers to create a design solution.
• Some designers find it too difficult to start with a blank piece of paper and try to come up with a design. The work of others gives a starting point.

Accept all other valid responses.</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>25</td><td></td><td>Maximum of four marks for detailed points but no examples given.

<table><tr><td>5–6 marks</td><td>A thorough and detailed explanation with clear, relevant discussion of a user-centred design approach. Excellent understanding of how it can be used to make sure products are fit for purpose. Clear example(s) given to support response.</td></tr><tr><td>3–4 marks</td><td>A good explanation with relevant supporting discussion on user-centred design. Some understanding of how user-centred design can be used to make sure products are fit for purpose. There may be example(s)s given to support response.</td></tr><tr><td>1–2 marks</td><td>Basic discussion with general points made around user-centred design and what it is. Little or no consideration of examples to support response</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table></td><td>6 marks</td><td>AO4 2b</td></tr>
<tr><td colspan="5">Indicative content

NB Example(s) may be actual products or methods used in user centred design

• Constant contact, feedback and discussion with the end user or client group e.g., questionnaire's, survey.
• Designing thinking about how specific people will use products.
• Designing thinking about what clients and end users will do with the product.
• User-centred design focusing on:
▪ a specific identified problem e.g., opening bottles and jars, mountain bike equipment storage.
▪ client-based approach e.g., GCSE projects where candidates identify an end user
▪ responding to customer feedback on existing products e.g., computer games and gaming hardware such as, virtual reality headsets, game graphics etc.
• Focused on the needs and wants of the client or end user to ensure the product meets their specific requirements e.g., a suit or wedding dress.
• User-centred design is focused on a specific target or end user group.
• User-centred design focuses on the needs and wants of the user at each specific phase of design and development.
• User-centred design will make use of primary and secondary research e.g., interviews, focus groups, user interactions.
• Focus group testing – to ensure the product works safely and correctly with its intended user group. Testing may flag up issues and/or changes that need to be made to improve how a product works for a future iteration e.g., battery life, camera, screen size on a mobile phone.

Accept all other valid responses.</td></tr>
</table>

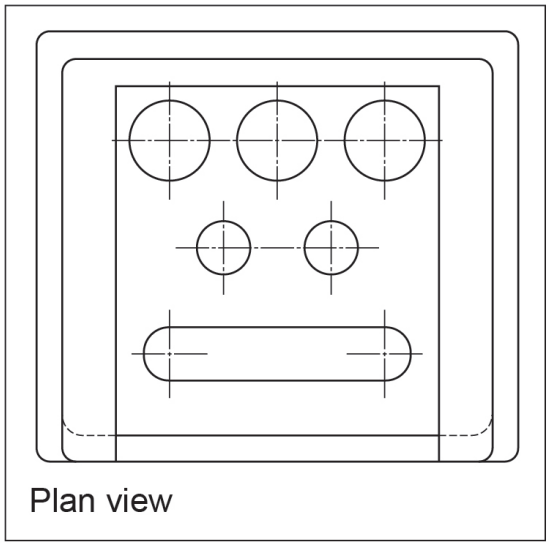
<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>26</td><td>1</td><td>Indicative content

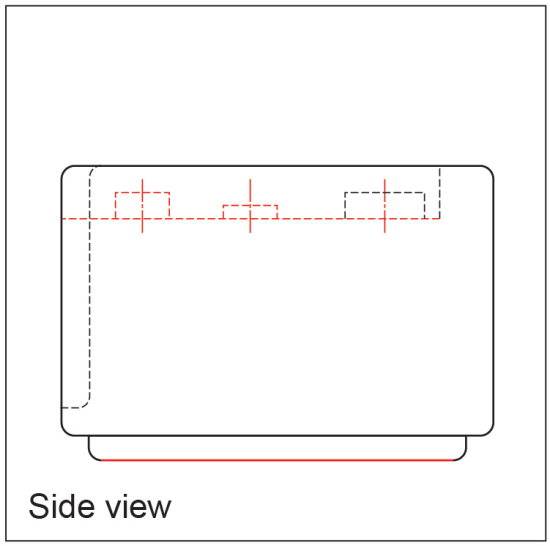
Any correct response:

<table><tr><td>1 mark</td><td>3rd angle
3rd angle projection
3rd angle orthographic projection
Orthographic
Orthographic drawing
Orthographic projection</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table></td><td>1 mark</td><td>AO4 2a</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>26</td><td>2</td><td>
<table>
<tr><td>1 mark</td><td>Added solid bottom horizontal line to side view</td></tr>
<tr><td>1 mark</td><td>Added hidden detail line for plane /part of plane on which buttons located</td></tr>
<tr><td>1 mark</td><td>Three sides of at least one button drawn in hidden detail</td></tr>
<tr><td>1 mark</td><td>Fully complete drawing including centre lines</td></tr>
<tr><td>0 marks</td><td>No attempt or nothing worthy of credit.</td></tr>
</table>
</td><td>4 marks</td><td>AO4 2c</td></tr>
<tr><td colspan="5">
The answer is looking for the correct use of centre lines and hidden detail lines to complete the drawing as shown below in red.

Indicative content

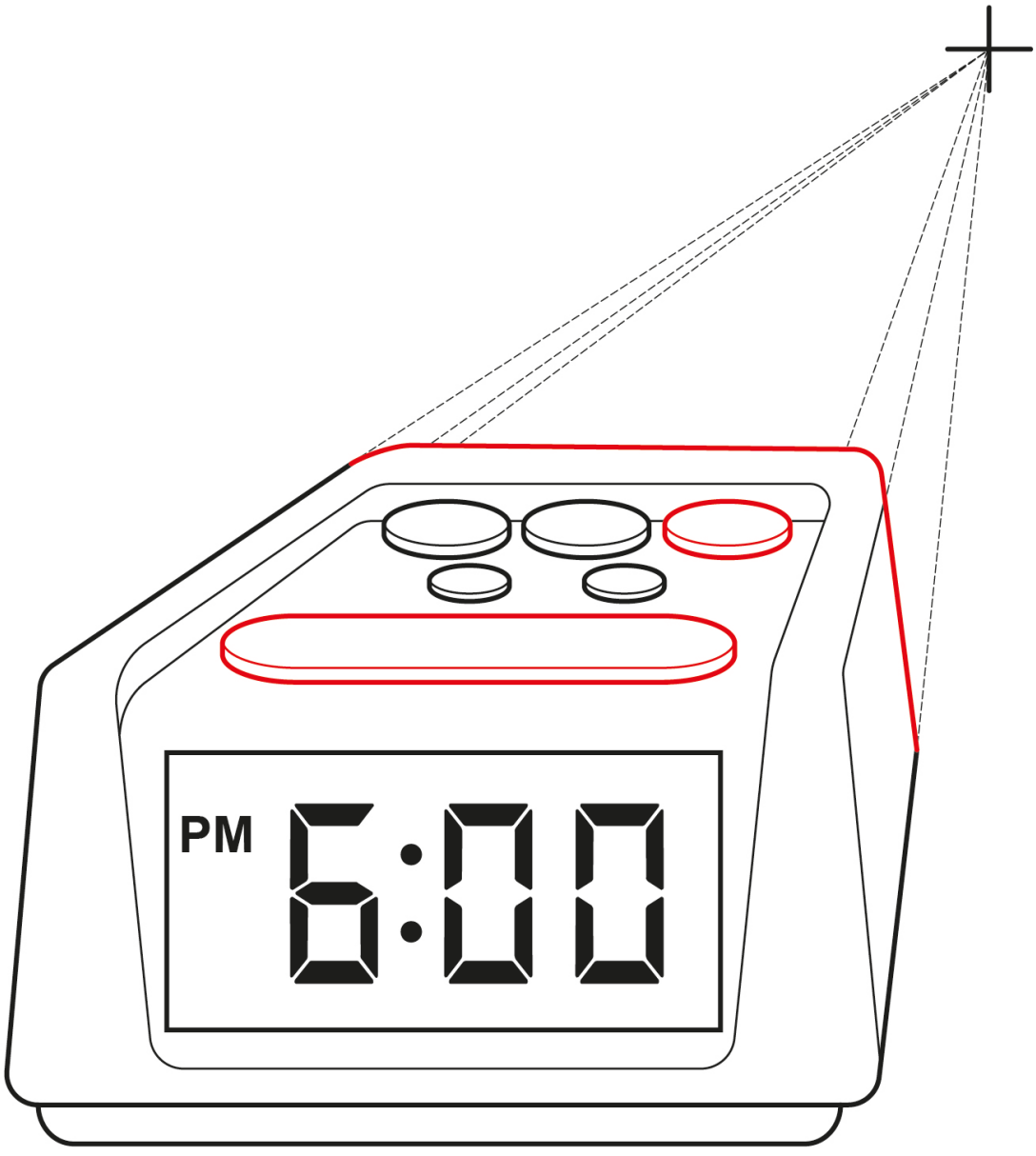




</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>26</td><td>3</td><td>
<table>
<tr><td>1 mark</td><td>Correct position of missing rear edge/back edge detail to drawing.</td></tr>
<tr><td>1 mark</td><td>Correct indication of a third button.</td></tr>
<tr><td>1 mark</td><td>Correct indication of a lozenge-shaped button.</td></tr>
<tr><td>1 mark</td><td>Accurate and correctly proportioned addition of all buttons and lines.</td></tr>
<tr><td>0 marks</td><td>No attempt or nothing worthy of credit.</td></tr>
</table>
</td><td>4 marks</td><td>AO4 2c</td></tr>
<tr><td colspan="5">Do not expect inclusion of lines drawn towards vanishing points.

Indicative content

 
</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>27</td><td></td><td>Maximum of two marks for each response.

<table><tr><td>2 marks</td><td>A detailed explanation of an advantage of using audio/visual recordings to develop ideas.</td></tr><tr><td>1 mark</td><td>A simple point clarifying an advantage of using audio or visual recordings to develop ideas.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table></td><td>4 marks</td><td>AO4 2b</td></tr>
<tr><td colspan="5">Indicative content

WE ARE NOT REWARDING SKETCHING OF IDEAS AS A VISUAL RECORDING.

Audio recordings

• Interviewing possible client’s/end users to find out their needs and wants.
• Gain feedback on your design ideas and prototypes before moving forward.
• Keep a record of discussion/information for retrieval later.
• You might forget the details of a discussion after time.
• Evidence of ownership/intellectual rights etc.
• Very quick way of recording information e.g., using your smartphone to record.
• Teams/Zoom meeting

Visual recordings

• Make a recording of a client or user group working with a potential product e.g., nursery children at play with a prototype toy.
• Interaction of end users with a product.
• Evidence of ownership/intellectual rights etc.
• Recorded 3D simulation of a product in CAD software.
• A visual recording of a prototype being tested to see how it performs.
• Video recording to help show how to dismantle and put together products e.g., clips on social media and on websites to help customers really see how to do something rather than look in an instruction manual.
• A video recording can be slowed down to see gradually how a product performs incrementally e.g., design of new sports equipment like running shoes.
• Video recordings of destructive and non-destructive testing.
• Teams/Zoom meetings.

Accept all other valid responses.</td></tr>
</table>

<table>
<tr><th>Qu</th><th>Part</th><th>Marking Guidance</th><th>Total marks</th><th>AO</th></tr>
<tr><td>28</td><td></td><td>Maximum of 2 marks per each issue.
<table><tr><td>2 marks</td><td>One point understanding in detail or two simple points of understanding given.</td></tr><tr><td>1 mark</td><td>One simple correct point made.</td></tr><tr><td>0 marks</td><td>No response or nothing worthy of credit.</td></tr></table>NB Two marks maximum for each response for fair trade and global warming.</td><td>4 marks</td><td>AO2b</td></tr>
<tr><td colspan="5">Indicative content

Fair trade

• Are people getting a fair price.
• Companies may want to improve their credentials as a fair-trade organisation when selling their new products.
• Promotes the company with more ethical credentials.
• Designers and manufacturers will want to know farmers can support their families.
• Workers’ rights.
• Safe working conditions.
• Are farmers in the developing world getting a fair price for their produce?
• Designers and manufacturers will recognise that good PR can help sales if working conditions are good for farmers (and their families).
• Manufacturers now know that some customers actively buy based on whether a product is fair trade or not e.g., coffee or chocolate.
• Moral purpose to ensure farmers and their families are not being exploited.

Global warming
• Don’t want to heat up the planet.
• Don’t want products that damage the planet.
• Don’t want to add to conditions that create extreme weather/drought.
• Designers/manufacturers may want to cut CO_2 emissions as they know it leads to global warming.
• Designers and manufacturers may employ strategies and techniques which don’t contribute to global warming e.g. use fossil fuels to power factories.
• Designers/manufacturers may want to cut CO_2 emissions as they know it leads to global warming. They won’t want to be responsible for damaging the planet more.
• Manufacturers may choose to promote a product as ‘climate friendly’ because it has lower CO_2 emissions and won’t contribute to global warming e.g., car manufacturers, TV manufacturers.
• Designers and manufacturers may calculate the carbon footprint of their business or product and aim for a state of net-zero carbon dioxide emissions.

Accept all other valid responses.</td></tr>
</table>